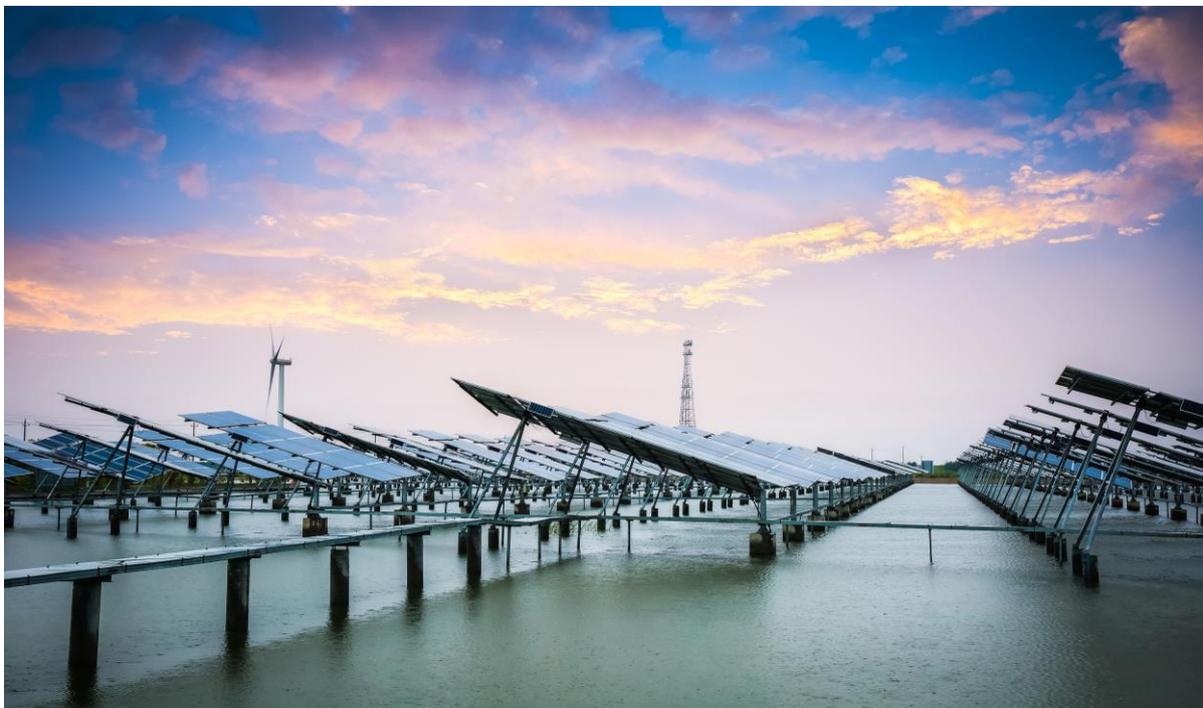




# DEVELOPING SECTORAL MRV SYSTEMS IN MYANMAR FOR LIVESTOCK SECTOR

December 2020



# LIST OF ACRONYMS

ADB	Asian Development Bank	MoA	Ministry of Agriculture and Irrigation
AEC	ASEAN Economic Community	MoALI	Ministry of Agriculture, Livestock and Irrigation
AFOLU	Agriculture, Forestry and Other	MoE	Ministry of Energy <sup>1</sup>
BUR	Biennial Update Report	MoECAF	Ministry of Environment, Conservation and Forestry <sup>2</sup>
CDC	City Development Committee	MoEE	Ministry of Electricity and Energy
CO <sub>2</sub> eq	Carbon dioxide equivalent	MoEP	Ministry of Electric Power <sup>3</sup>
DCA	Department of Civil Aviation	MoGE	Myanmar Oil and Gas Enterprise
DMA	Department of Marine	MoI	Ministry of Industry
DRD	Department of Rural Development	MoLFRD	Ministry of Livestock, Fisheries and Rural Development <sup>4</sup>
ECD	Environmental Conservation	MoM	Ministry of Mines <sup>5</sup>
EDC	Energy Development Committee	MoNREC	The Ministry of Natural Resources and Environmental Conservation
EE	Energy Efficiency	MoST	Ministry of Science and Technology
EECD	Energy Efficiency and Conservation Division	MoTC	Ministry of Transport and Communication
EE&C	Energy Efficiency and Conservation	MPA	Myanmar Port Authority
EIA	Environmental Impact	MPE	Myanmar Petrochemical Enterprise
EPGE	Electric Power Generation Enterprise	MPPE	Myanmar Petroleum Products Enterprise
EST	Environmentally Sound Technology	MR	Myanmar Railways
ETPA	Education, Training and Public Awareness	MSDP	Myanmar Sustainable Development Plan
FDI	Foreign Development Index	NC	National Communication
GGGI	The Global Green Growth Institute	NDC	Nationally Determined Contributions
GHG	Greenhouse gases	NEMC	National Energy Management
GMS	Greater Mekong Sub-region	NGHGI	National Greenhouse Gas Inventory
GPG	Good Practice Guidance	NGOs	Non-government Organizations
IEP	Integrated energy planning	NMVOC	Non-methane Volatile Organic Compound

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<sup>1</sup> Ministry of Energy was merged into Ministry of Electricity and Energy in 2016

<sup>2</sup> Ministry of Environment, Conservation and Forestry was merged into Ministry of Natural Resources and Environmental Conservation in 2016

<sup>3</sup> Ministry of Electric Power was merged into Ministry of Electricity and Energy in 2016

<sup>4</sup> Ministry of Livestock, Fisheries and Rural Development was merged into Ministry of Agriculture, Livestock and Irrigation in 2016

<sup>5</sup> Ministry of Mines was merged into Ministry of Natural Resources and Environmental Conservation in 2016

INC	Initially National Communication	NSDS	The National Strategy for Development of Statistics
INDC	Intended Nationally Determined Contribution	OGPD	Oil and Gas Planning Department
INGOs	International Non-Government	PIP	Project Implementation Plan
IPCC	Intergovernmental Panel on Climate Change	PMT	Project Management Team
IWT	Inland Water Transport	PRC	The People's Republic of China
ktoe	Kilo tonnes of oil equivalent	QA/QC	Quality Assurance and Quality Control
kton	Kilo tonnes	REAM	Renewable Energy Association Myanmar
LPG	Liquefied petroleum gas	RTAD	Road Transport Administration Department
LULUCF	Land use, land-use change, and forestry	RSO	Research and Systematic Observation
MCCSAP	Myanmar Climate Change Strategy and Action Plan	SDG	Sustainable Development Goal
MEP	Ministry of Electric Power	SME	Small and Medium Enterprise
MES	Myanmar Engineering Society	SNC	Second National Communication
MGS	Myanmar Geoscience Society	TFEC	Total Final Energy Consumption
MNA	Myanmar National Airline	TWG	Technical Working Group
Mtoe	Million tonnes of oil equivalent	UNFCCC	United Nations Framework Convention on Climate Change
MRV	Monitoring, Reporting and Verification	V&A	Vulnerability and Adaptation

# ACKNOWLEDGEMENTS

GGGI is supporting the Republic of the Union of Myanmar in developing the country's MRV systems to support the country's reporting against the Article 13 enhanced transparency framework requirements of the Paris Agreement. GGGI would like to thank the staff of the several departments and ministries in Myanmar who participated in meetings. The report was prepared by Siddhartha Nauduri (GGGI) and benefits from inputs from U Kyaw San Naing (MONREC), Daw Su Su Lwin (MONREC), U Kyaw Moe Aung (UNEP-SNC), U Aung Thu Han (MONREC), U Min Myat Aung (MONREC), Aaron Russel (GGGI), Thiha Aung (GGGI) and Yoolim Jeon (GGGI).

# EXECUTIVE SUMMARY

The enhanced transparency framework of the Paris Agreement requires countries to measure, report and verify their greenhouse gas emissions and removals, mitigation, and adaptation measures transparently, accurately and consistently. Myanmar has embarked on this journey by taking the lessons learnt from its reporting systems under the UNFCCC, and identifying the gaps and working internally and with development partners on improving internal systems and capacities. In this regard, GGGI is collaborating with the ECD in developing the MRV systems for future reporting. GGGI concluded a gap assessment in 2017, and in the following years has continued to work on Energy sector and on other capacity-building initiatives. Between 2019 and 2020, GGGI has worked on identifying the existing systems under UNFCCC that can be used *mutatis mutandis* to meet the ETF requirements under Paris Agreement.

This report is expected to be a living document to serve as a primary point for starting the data and information gathering exercises for preparing future GHG inventories as per the ETF requirements under the Paris Agreement for the Agriculture sector, specifically the Livestock sub-sector. It first covers the requirements arising out of the modalities, procedures and guidelines (MPG) of the ETF of the Paris Agreement as agreed at Katowice in 2018, and then indicates the data and information required to progress towards Tier 2 MRV systems. GGGI conducted stakeholder analysis to study institutional arrangements, legal infrastructure, and internal processes for developing GHG inventory within the country.

## Agriculture Sector

The agriculture sector contributes to one of the largest components of national GHG emissions. While the country has submitted its initial national communication, it is still working on its second national communication. However, understanding the importance of this sector, its contribution to national GHG inventory as well as the opportunities within to reduce these emissions, the country has identified the sector has one of the primary contributors to help it achieve its GHG ambitions in its updated nationally determined contributions (NDC) to be soon submitted to UNFCCC. Myanmar commits to promote climate-resilient productivity and climate smart responses in the agriculture, fisheries, and livestock sectors to support rural food security and livelihood strategies while also promoting resource-efficient and low-carbon practices that may enhance development of new markets and products. Agriculture, fisheries and livestock sectors are also quite important for the country in terms of adaptation, they are extremely vulnerable to global climate change and require urgent actions to understand and prepare response measures for these potential changes.

## Challenges and gaps

For the preparation of national GHG inventory, the sector faces challenges similar to other sectors. While the country has hitherto taken a project-by-project approach to preparing GHG inventories, through the capacity building initiative for transparency funds through the Global Environment Facility, Myanmar is building its national capacities, both systemic and human, to prepare for future reporting requirements.

Common cross-cutting issues between the Livestock sub-sector and others are:

1. Lack of extensive stakeholder consultation systems for gathering information and data. While there are several stakeholders within the country, the distributed nature of these economic activities, limited institutional and human capacity as well as private sector engagement are few of the principal challenges in improving the overall MRV system.

2. Clearly defined roles and responsibilities of the stakeholders are currently non-existent and those who are aware of them lack access to correct tools and technologies for data and information collection.
3. Improving access to primary sources of data from secondary sources, and thereby improving the overall quality of the GHG inventory that can be prepared, is an important issue to be addressed.
4. Relevant ministries and departments have other priorities and limited human and financial capacities to redirect to climate change data and information gathering systems. The results are vastly improved when they do get these resources, but they are short-lived as there are no systems currently in place to institutionalize these lessons learnt.
5. There are no dedicated staff or positions in all relevant Government departments planned and tasked with this responsibility. Activities, such as the SNC and BUR, are currently conducted on an ad-hoc basis with funding from external agencies and they are building the necessary institutional memories.
6. The existing Government systems for data and information sharing are non-existent, and where such data and information sharing occur, they happen through hierarchical procedures and are not often at the speed that enables smooth and quick preparation of GHG inventory.
7. Data and information collection templates have to be improved and understood not just by the key coordinating agency or first line ministries, but as well by the sub-national institutions and primary data providers.
8. Issues of data retention, security and retrieval are not adequately addressed, as the country lacks a dedicated GHG management system.

#### **Agriculture sector – Livestock sub-sector**

9. The country has prepared its National GHG inventories for the agriculture sector using Tier 1 systems, relying on default emission factors and third party activity data sources.
10. To progress to Tier 2 systems, the country has to improve its livestock classification and disaggregation systems.
11. The country also has to prepare country-specific emission factors to improve its overall sectoral accuracy, and reduce the uncertainties involved in GHG emission estimations.

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## INTRODUCTION

1. The Global Green Growth Institute (GGGI) is an intergovernmental organization based in Seoul, founded to support and promote a model of economic growth known as "green growth", which targets key aspects of economic performance such as poverty reduction, job creation, social inclusion, and environmental sustainability. GGGI works with countries around the world, building their capacity and working collaboratively on green growth policies that can impact the lives of millions. The organization partners with countries, multilateral institutions, government bodies, and the private sector to help build economies that grow strongly and are more efficient and sustainable in the use of natural resources, less carbon intensive, and more resilient to climate change.
2. Republic of the Union of Myanmar has ratified the Paris Agreement (PA), and it came into effect on 19 October 2017. A robust measurement, reporting, and verification (MRV) system is essential to track and report its progress toward climate change mitigation under the enhanced transparency framework (ETF) of the PA. Myanmar is developing its institutional arrangements and systems to meet its reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC). The country is currently in the process of preparing its second national communications (SNC) and is also preparing its initial biennial update report (BUR) with support from the United Nations Environment Program (UNEP) which requires more accurate and reliable data sources.
3. While the country is making giant progress on building institutional capacities, Myanmar continues to face challenges in choosing the appropriate tools and methods used for calculating the GHG emissions, identifying nationally appropriate mitigation actions (NAMA) and their requisite MRV methods, and continues to have large gaps in vulnerability and adaptation assessment. Moreover, the reporting obligations under the ETF of PA add a layer of stringency and require expanded institutional and technical capacities across several government departments and at both national and sub-national levels. This means that the country needs additional technical and capacity-building support.
4. In this backdrop, Myanmar has been developing an integrated national MRV system with technical assistance from GGGI. In 2017, as part of the preliminary analysis, GGGI carried out a gap assessment of the MRV system in Myanmar and hosted an inception workshop with the Environmental Conservation Department (ECD) to share understanding of the MRV development of the government of Myanmar. In 2018, GGGI developed national MRV system baseline for the energy sub-sector in partnership with the ECD. The key institutions were identified, the policy frameworks within which data required for the preparation of a national GHG inventory were evaluated, and the stakeholders responsible for data assimilation and consolidation were identified. In 2019, GGGI initiated its support to Myanmar in accessing climate finance with capacity-building initiative for transparency (CBIT) funding from the Global Environment Facility (GEF), the key financing agency of the Paris Agreement as well, for setting up the national MRV systems in the country through partnership with UNEP. Through enhanced institutional and technical capacity, it is expected that the initiative will enable Myanmar to become better equipped to understand their baseline and track progress towards NDC targets.
5. Based on Myanmar's request for GGGI to support nationally determined contributions (NDC) implementation and financing, GGGI will support government in establishing an MRV system to facilitate data collection and report generation requisite for national and international review. To introduce MRV in Myanmar, GGGI conducted a detailed stakeholder and situation analysis to assess the current institutional capacity and data availability for such a system, to eventually

build on the existing mechanisms and institutional roles and responsibilities, strengthen capacity to collect and manage data, and support the aggregation of this information into reports and inventories. The MRV system will incorporate poverty reduction, gender and social inclusion metrics in its design in order to strengthen buy-in for mitigation action among policy makers and their constituencies, showcasing the social impact of mitigation.<sup>6</sup> This report is part of the wider GGGI support to the country, which includes evaluations on other sectors and a train the trainer program which was organized in collaboration with Australian Volunteers program.

## Country context

6. Myanmar is an LDC in Southeast Asia, with a population of 51.4 million and a per capita income of \$1,105. Since 2011, Myanmar has begun transition to a market economy, and from military rule to democracy. The opening up of the economy has accelerated growth, with a 6.5 percent growth average since 2011. Myanmar relies heavily on natural resources such as energy, minerals, forestry, and agriculture for its main exports and industries, which makes it essential that its growth pattern is environmentally sustainable. Myanmar's potential needs to be unlocked through careful analysis and by charting a sustainable development path that generates strong economic, environmental and social outcomes.

### Initial National Communication

7. The first national communication was officially submitted to UNFCCC in 2012. The key information in INC are summarized as follow-
  - a. Myanmar is a sink country with the net removal of ~67,000 Gg CO<sub>2</sub> eq;
  - b. Agriculture and Other Land Use Sectors are key categories for GHG emissions and removals.
  - c. IPCC 2006 guideline was used at Tier 1 level;
8. Based upon the INC submission, Project Implementation Plan - PIP for second national communication report preparation was formulated to implement the following activities (preparation of NC report chapters);
  - a. Introduction and Institutional Setup
  - b. National Circumstance
  - c. National Greenhouse Gas Inventory on
  - d. Energy Sector
  - e. Industrial Sector
  - f. Agriculture Sector
  - g. Land Use Change and Forestry Sector
  - h. Waste Sector (Myanmar Energy Sector Assessment, Strategy and Roadmap, 2016) (Myanmar's Intended Nationally Determined Communication - INDC, 2015) (Myanmar's Intended Nationally Determined Communication - INDC, 2015) (Myanmar's Intended Nationally Determined Communication - INDC, 2015)

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<sup>6</sup> Seres, Stephen. 2017. The Status of Monitoring, Reporting and Verification of Nationally Determined Contributions to Climate Actions in Myanmar. GGGI/MONREC MRV Project Report No.1

- i. Measures to facilitate vulnerability assessment and adaptation options
  - j. Measures to facilitate Climate Change Mitigation;
  - k. Other information on (Environmentally Sound Technology; Climatic Research and Systematic Observation; Education, Training and Public Awareness);
  - l. Constraints and Gaps in terms of Finance, Technology and Capacity Building.
9. The first national communication of Myanmar, prepared as per the IPCC 2006 guidelines, with the base year of 2000 covered the following sources:
  10. A detailed list of activity and source structure in the Energy Sector according to 2006 IPCC Guidelines is provided in Appendix I. The following types of GHGs will be covered, as per the IPCC 2006 guidelines: CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>.
  11. The current inventory of GHG emissions from energy consumption took into account all emissions from fossil fuel combustion. Fuel combustion, one of the largest contributors to GHG emissions in Myanmar, can be broadly categorized into four groups for emission assessment, i.e. energy industries, manufacturing industries and construction, transport and other sectors having emissions from energy consumption. Myanmar's commercial energy resources depended almost fully on hydropower and fossil fuels. The emission sources in the sector of electric power and heat supply were defined to be the power generation and heat supply of Myanmar's thermal power utilities while the emissions from auxiliary power plants and other sources of heat supply were reported in the relevant sectors. Machineries and equipment for fossil fuel combustion composed of gas turbines and combined cycle power plants, power generating boilers, industrial boilers, industrial kilns, household cooking ovens, farm implements, power-generation internal-combustion engines, different kinds of aviation vehicles, road transport vehicles, railway transport vehicles, shipping transport vehicles, etc.
  12. The national GHG inventory for the energy sector covered three major GHGs: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O. The main sources of GHG emissions examined are fossil fuel combustion, traditional biomass fuel combustion, fugitive emissions from coal mining activities, and oil & natural gas system. The total GHG emissions from energy sector of Myanmar were estimated to be 7,863.47 Gg CO<sub>2</sub>e most of which come from fossil fuel combustion according to Myanmar INC 2012. CO<sub>2</sub> emissions accounted for 97 % of total emissions while CH<sub>4</sub> and N<sub>2</sub>O emissions shared only 2% and 1% respectively.
  13. Currently, Myanmar has been using different types of primary energy sources such as solid and liquid fuels. The main sources of GHG emissions in the energy sector are fossil fuel combustion, traditional biomass fuel combustion, fugitive emissions from coal mining activities, and oil and natural gas system. Three different gases are tracked which are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) in national GHG inventory of energy sector<sup>7</sup>.

### Second National Communication

14. The country is in the process of preparing and submitting its second national communication. The project, which began in 2017 is still on-going. This further highlights the need for the country to enhance its human and technical capacities to meet the reporting obligations under the Paris Agreement.

### Intended Nationally Determined Contribution

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<sup>7</sup> Myanmar's Initial National Communication Under the United Nation Framework Convention on Climate Change (UNFCCC), 2012

15. Myanmar has submitted its INDC in 2015 and its NDC released in 2017. Mitigation actions from INDC, and probable data to be measured include:
  - a. Renewable energy – Hydroelectric power. Increase the share of hydroelectric generation within limits of technical hydroelectric potential and instead of the development of fossil fuel-based power generation. Indicative data and information to be collected and measured: installed capacity, planned capacity, emission factors for the grid, grid-connected or off-grid, water sources other non-carbon benefits; and at later stages, potential sources of methane emissions.
  - b. Renewable energy – Rural electrification. To increase access to clean sources of electricity amongst communities and households currently without access to an electric power grid system. The Project will support the scale-up of low carbon energy through grid connections and renewable or hybrid energy for village-scale mini-grids and off-grid solar home systems to replace current fossil fuel sources of electricity and lighting including diesel and kerosene. Indicative data and information to be collected and measured: types of renewable energy available; potential of exploitable renewable energy available and utilized; emission factors for the renewable energy sources; grid-connectivity / off-grid access points; non-carbon benefits.
  - c. Energy efficiency – industrial processes. To mitigate GHG emissions in the rapidly developing industrial production sector by reducing energy consumption by 20% by 2030 against the base year of 2012. Indicative data and information to be collected and measured: Existing baseline of select industrial processes for energy consumption, projections for demand in the next short to long-term, supply-side and demand-side energy-efficiency audits, baseline fuels, emission factors, grid-connectivity / off-grid access points; non-carbon benefits.
  - d. Energy efficiency – cook stoves. To increase the number of energy efficient cook stoves distributed in order to reduce the amount of fuel wood used for cooking.<sup>8</sup> Indicative data and information to be collected and measured: Baseline fuel consumption, categorization, renewable and non-renewable biomass categorization, cookstove usage, suppressed-demand estimation and calculation, any other methodology-related parameters.
16. Myanmar's Climate Change Strategy and Action plan's ultimate goal is to plot out climate resilient, low carbon and sustainable development pathway for the country. For the energy sector, this means choosing a development strategy that minimizes social and environmental impacts while expanding access to energy to the public and for economic development.
  - a. Expand energy access to the public using renewable and low-impact technologies. The INDC targets 6 million people living in rural areas to gain access to electricity from micro-hydro, biomass, wind and solar mini-grid technologies.
  - b. Increase the role of renewable energy throughout the energy sector.
  - c. Promote technology transfer, capacity building, and funding to minimize the environmental impacts of energy sector development

### Updated NDC

17. The revised and updated NDC is under final stages of confirmation for submission to UNFCCC.

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<sup>8</sup> Myanmar's Intended Nationally Determined Communication- INDC, 2015

18. Agriculture is the second largest sectoral source of GHG emissions in Myanmar, accounting for 32.1% in the 2013 baseline year<sup>9</sup>, with the primary contributors being rice cultivation (~12%), and enteric fermentation (~9%). These GHG emissions are closely associated with deforestation and land-use change for agricultural expansion (both large and small scale). The Government's commitment to the Paris Agreement provides an opportunity for Myanmar to recognize the contributions made by the agricultural sector to contribute to climate change adaptation, while also to examine major sources of GHG emissions.
19. As of date, Myanmar lacks a national inventory for agroforestry or tree cover on agricultural lands. The country has committed to a conditional target to promote tree planting and agroforestry techniques to increase tree canopy cover across 275,000 ha on those agricultural lands with current tree cover <10% per hectare.
20. The NDC notes that the country does not have a centralized registry of the activities implemented by the government and its partners to promote agroforestry on agricultural lands, so it is not yet able to quantify numbers of trees planted, biomass accumulated or tCO<sub>2</sub>e removals.
21. The NDC also indicates the lack of baseline data for the agriculture system. The baseline data to be collected and analyzed include the following:
  - a. Laws, policies, and regulations pertaining to agroforestry to identify opportunities for synergies with relevant sectors and to understand and address constraints and challenges hindering agroforestry implementation.
  - b. Geographic distribution by type of agroforestry systems and practices, including areal extent of tree cover, species' composition and uses, and gendered-roles and socio-economic outcomes in different agro-ecological zones.
  - c. Mitigation benefits (CO<sub>2</sub> emissions and removals) for different types of agroforestry systems and practices in different geographies
  - d. Adaptation benefits from agroforestry systems, production and value-chains, and their impacts on key regulatory services (soil health and erosion, crop pollination and pest-control, microclimate temperature and rainfall) that enhance climate resilience of cropping systems.
22. The updated NDC does not include any specific targets for the livestock sub-sector. However, it is identified as one of the important sectors for adaptation.

## Need for developing MRV system

23. The need for developing a robust MRV system for the country emanates from the requirements under the enhanced transparency framework (ETF) of the Paris Agreement, codified in its Thirteenth Article.
24. At Katowice in 2018, the modalities, procedures and guidelines (MPG) for the Article 13 were agreed upon by the Parties.
25. As previously indicated, the country has had experience in meeting its reporting obligations under the UNFCCC. However, the country has faced challenges and gaps in implementing the projects.

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<sup>9</sup> FAOSTAT (2017). Myanmar, emissions: agriculture total. Viewed 18 March 2017. In: USAID. 2017. Greenhouse gas emissions in Burma.

26. The FNC was communicated in 2012, the SNC is still in the workings, and the country has only now started its work on its first BUR.
27. In Myanmar, some MRV-related initiatives are already in place and therefore it makes sense to build on the existing structures. However, these structures are often disparate.
28. The country still faces systemic challenges of tackling its reporting obligations on a project-by-project basis and doesn't have institutional arrangements in place to implement them seamlessly.
29. The enhanced reporting obligations under the Paris Agreement require the country to quickly update its systems and capacities to enable the country to submit its first biennial transparency report (BTR) by 2024.
30. This report was undertaken with a focus on MRV systems for GHG inventory. The scope of evaluation was restricted to Livestock sub-sector within Agriculture sector.

## The Enhanced Transparency Framework of the Paris Agreement

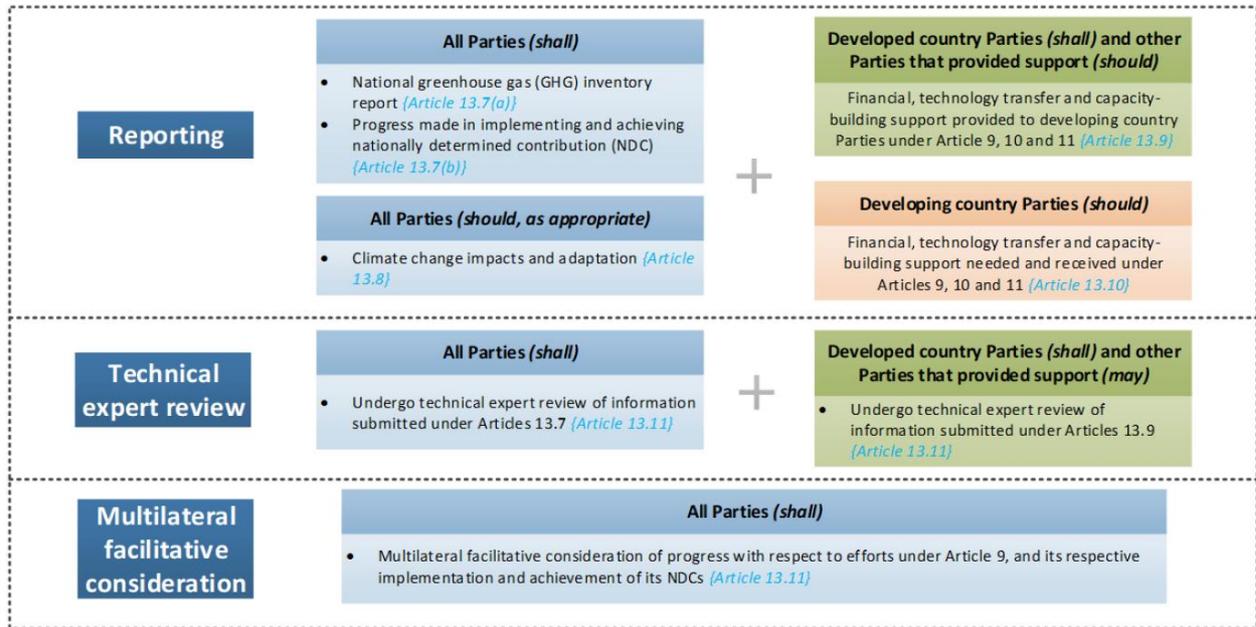


Figure 2: Verification under the ETF

13.7 13.9 13.10

31. The knowledge and experience from the design and implementation of measurement, reporting and verification (MRV) systems under the UNFCCC were the basis for the enhanced

transparency framework (ETF) of the Paris Agreement. The modalities, procedures and guidelines (MPG) of the Article 13 of the Paris Agreement were agreed at COP24 at Katowice in 2018. While they exhaustively cover the requirements for both developing and developed countries, a blurring of distinction fundamental to the Paris Agreement, they have in-built flexibilities for those developing countries that need it. These flexibilities are embedded both in the Paris Agreement itself as well as the MPGs. Few of the critical elements pertaining to developing countries are summarized below.

32. The ETF sets the following requirements for all Parties to the Paris Agreement, specifically focused on the developing country Parties. Underpinning the different rules and regulations and norms of the Paris Agreement is the requirement to assess the progress being made on a global scale to reduce GHG emissions; either predict or assess the short, medium and long-term impacts of climate change; adapt to these expected changes in climate and collectively assess the climate finance needed to carry out these activities.

## Guiding principles

33. The guiding principles of the ETF are identified in the MPGs as follows:
  - a. Building on and enhancing the transparency arrangements under the Convention
    - i. recognizing the special circumstances of the least developed countries
    - ii. facilitative, non-intrusive, non-punitive manner, respecting national sovereignty and avoiding placing undue burden on Parties
  - b. Facilitate improved reporting and transparency over time;
  - c. Provide flexibility to those developing country Parties that need it in the light of their capacities;
  - d. Promote transparency, accuracy, completeness, consistency and comparability;
  - e. Avoid duplication of work and undue burden on Parties and the secretariat;
  - f. Ensure that Parties maintain at least the frequency and quality of reporting in accordance with their respective obligations under the Convention;
  - g. Ensure that double counting is avoided;
  - h. Ensure environmental integrity

## Flexibility to those developing country Parties that need it in the light of their capacities

34. One of the principal considerations of the Paris Agreement and its MPGs is the flexibility afforded to countries that need it in line of their capacities. Embedded in the Paris Agreement itself, with clear mandate to have the principle embedded in the MPGs of its implementation, these flexibilities offer countries that need them in light of their limited capacities to opt for them during implementation. The MPGs:
  - a. Provide flexibility in the implementation of the provisions of Article 13

- b. In the scope, frequency and level of detail of reporting, and in the scope of the review
- c. Self-determined – *i.e., they are determined by the Party itself*
- d. Flexibility description
  - i. Clearly indicate the provision to which flexibility is applied
  - ii. Concisely clarify capacity constraints, noting that some constraints may be relevant to several provisions, and
  - iii. Provide self-determined estimated time frames for improvements in relation to those capacity constraints
- e. The technical expert review teams **shall not review** the Party's determination to apply such flexibility or whether the Party possesses the capacity to implement that specific provision without flexibility

## MPGs of Article 13

- 35. COP 24 (Katowice, 2018) agreed that common time frames shall be applied from NDCs to be implemented from 2031 onwards. As it is expected that NDCs shall be submitted five years before the start of their timeframes, this means that the common timeframes will be applied to the NDCs submitted in 2025. While the specific contents of the NDCs has not been decided, the following elements that have to be reported under the biennial transparency reports (BTR) mean that the information should be monitored by the country and be the basis for the revision of the NDC.
- 36. The ETF of the Paris Agreement<sup>10</sup> has set expanded the requirements for Parties to measure, report and verify their climate actions and information provided under their national GHG inventory.
- 37. While the ETF has converged all reporting requirements for both developing and developed countries, there are embedded flexibilities provided in the Paris Agreement for those countries that need them in light of their capacities, with special regard to LDCs and SIDs.
- 38. The Chapter II of the MPGs, contains provisions on the following for GHG inventories submitted by Parties:
  - a. Definitions
  - b. National circumstances and institutional arrangements
  - c. Methods, including:
    - i. Methodologies, parameters and data
    - ii. Key category analysis
    - iii. Time series consistency and recalculations
    - iv. Uncertainty assessment
    - v. Assessment of completeness

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<sup>10</sup> [https://unfccc.int/sites/default/files/resource/ETF\\_technical%20handbook\\_First%20Edition.pdf](https://unfccc.int/sites/default/files/resource/ETF_technical%20handbook_First%20Edition.pdf)

- vi. QA/QC;
- d. Metrics
- e. Reporting guidance on information to be reported, including:
  - i. Information on methods and cross-cutting elements
  - ii. Sectors and gases
  - iii. Time series

## Evaluation methodology

39. A series of questions were discussed with the key coordinating agencies, and their feedback collected. The following analysis is based on the feedback received and further one-on-one discussions that were carried out in person and online.
40. The discussions centred around the following elements:
  - a. First the above ETF framework was presented to facilitate the understanding of requirements, as well as providing the explanations on the flexibilities inherent to the ETF MPGs were discussed.
  - b. Institutional arrangements: how the organization or department participated in previous GHG inventories, the information they provided and how they communicated these with the coordinating agency. Issues of their ability to collect primary data and their human, technical and financial capacities were also discussed.
  - c. Activity data and information: The organization or department's ability to gather key data points against the IPCC 2006 Guidelines were discussed, including the frequency of collection, systems of collection and data verification. Issues of data quality checks and retention and retrieval were also discussed.
  - d. Emission factors: whether the organization or department provided emission factors data, or if it had the ability to provide these data points were discussed.
  - e. Laws and regulations: this was primarily to understand the existing laws and regulations that facilitated data and information sharing not just within the country, but across different ministries. Issues of data sensitivity, confidentiality and records were discussed.

# AGRICULTURE SECTORAL SCOPE FOR MYANMAR

41. The IPCC 2006 Guidelines specify the data and information required to assess the GHG emissions from the agriculture sector. While the guidelines cover various activities, not all of them are relevant to Myanmar. Therefore, in the following pages, the results of the exercises carried out to identify the major sub-sectors and activities within the country are summarized.
42. Myanmar continues to rely on Tier 1 systems for preparing the Agriculture sector's GHG inventory in the SNC. To support the country to progress to Tier 2 systems in all relevant sub-sectors of the Agriculture sector, this document identifies first the scope of sectors within the IPCC 2006 Guidelines that are important and relevant to the country.

## 3A: Enteric Fermentation & Manure Management

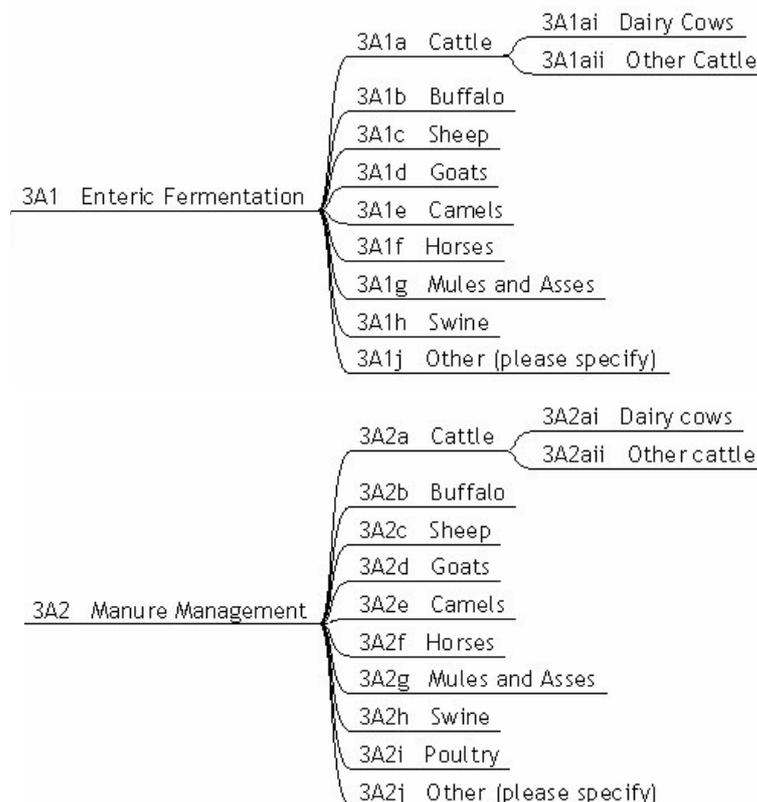


Table 1: Relevant IPCC 2006 Guidelines sub-sectors in Myanmar under Enteric Fermentation

Sub-sector	Activity	Relevance to Myanmar	Relevant Ministry
3A1a & 3A2a	Cattle	Relevant sub-sector	Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation
3A1ai & 3A2ai	Dairy cows	Relevant sub-sector	Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation
3A1aii & 3A2aii	Other cattle	Relevant sub-sector	Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation
3A1b & 3A2b	Buffalo	Relevant sub-sector	Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation
3A1c & 3A2c	Sheep	Relevant sub-sector	Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation
3A1d & 3A2d	Goats	Relevant sub-sector	Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation
3A1e & 3A2e	Camels	Not relevant	-
3A1f & 3A2f	Horses	Not relevant	-
3A1g & 3A2g	Mules and Asses	Not relevant	-
3A1h & 3A2h	Swine	Relevant sub-sector	Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation
3A1j & 3A2j	Other	Not applicable	-

## Data Sources and Methodologies for Livestock and Manure Management

43. Livestock and manure management is one of the major contributors to national GHG emissions, especially methane (CH<sub>4</sub>).
44. Livestock population and feed characterisation data is common between for estimating and calculating the GHG emissions from both enteric fermentation and manure management.
45. Tier 1 systems that have been hitherto used in the country rely on default emission factors, and estimated data for livestock population. While the country is attempting to improve its data and

information collection systems, the GHG emission estimates have relied on third party estimates, such as those from FAO.

46. Tier 2 systems requires information on the following key components and enhanced characterisations of:
  - a. Livestock sub-categories
  - b. Annual population, and sub-classification
  - c. Feed intake and characterisation
47. While the above data points are common for both Tier 1 and Tier 2 systems, the granularity of data points and gathering it from sub-national levels instead of national statistics is the characteristic of higher Tier systems.
48. For each of the representative animal categories defined, the following information is required:
  - a. Annual average population (number of livestock or poultry as per calculations for Tier 1);
  - b. Average daily feed intake (megajoules (MJ) per day and / or kg per day of dry matter); and
  - c. Methane conversion factor (percentage of feed energy converted to methane)
49. The following data for grazing livestock, and other types of livestock as well has to be collected. The following animal performance data are required for each animal subcategory to estimate feed intake for the subcategory:
  - a. Weight (kg): representative samples for live-weight data is to be collected
  - b. Average weight gain per day (kg): assuming zero for mature animals;
  - c. Mature weight (MW) (kg)
  - d. Average number of hours worked per day: for draft animals, which are relevant to Myanmar, the average number of hours worked per day must be determined
  - e. Feeding situation: confined, grazing, pasture conditions;
  - f. Milk production per day (kg/day) and fat content (%): Milk production data are required for dairy animals. These can be estimated for non-dairy animals providing milk to young, where data are available. These data are for milking ewes, dairy cows and buffalo. The average daily production should be calculated by dividing the total annual production by 365, or reported as average daily production along with days of lactation per year, or estimated using seasonal production divided by number of days per season. If using seasonal production data, the emission factor must be developed for that seasonal period.
  - g. Fat content (%) of the milk is required for lactating cows, buffalo and sheep producing milk for human consumption.
  - h. Average amount of work performed per day (hours/day);
  - i. Percentage of females that give birth in a year, relevant for mature females;
  - j. Wool growth / Average annual wool production per sheep (kg/year): The amount of wool produced in kilograms (after drying out but before scouring) is needed to estimate the amount of energy allocated for wool production.
  - k. Number of offspring; and
  - l. Feed digestibility (%): the portion of gross energy (GE) in the feed not excreted in the faeces is known as digestible feed.

- m. Mean winter temperature: Detailed feed intake models consider ambient temperature, wind speed, hair and tissue insulation and the heat of fermentation but are not generally required for Tier 2 systems.
50. Special case of gross energy calculations exist for the key ruminant categories of cattle, buffalo and sheep, all of which are relevant to Myanmar. Metabolic functions and other estimates for these animals differ, specifically between sheep versus cattle and buffalo. The factors are:
- a. Net energy for maintenance
  - b. Net energy for activity
  - c. Net energy for growth
  - d. Net energy for lactation
  - e. Net energy for work
  - f. Net energy for wool production
  - g. Net energy for pregnancy
  - h. Ratio of net energy available in diet for maintenance to digestible energy consumed
  - i. Ratio of net energy available for growth in a diet to digestible energy consumed
51. For Myanmar to improve its national GHG inventory, more studies have to be carried out to gather above data points for each type of cattle, buffalo and sheep. Some of the above factors also vary with temperature and Myanmar does present different climate profiles<sup>11</sup>.
52. Once the values for GE are calculated for each animal subcategory, the feed intake in units of kilograms of dry matter per day (kg/day) is calculated. To convert from GE in energy units to dry matter intake (DMI), divide GE by the energy density of the feed.
53. A default value of 18.45 MJ/kg of dry matter can be used if feed-specific information is not available.
54. The resulting daily dry matter intake should be in the order of 2% to 3% of the body weight of the mature or growing animals. In high producing milk cows, intakes may exceed 4% of body weight.

## Methane emissions from Enteric Fermentation

### Activity data choices

- 55. The Tier 2 method is applied to more disaggregated livestock population categories and used to calculate emission factors, as opposed to default values. The key considerations for the Tier 2 method are the development of emission factors and the collection of detailed activity data.
- 56. IPCC 2006 Guidelines suggest the best approaches for estimating GHG emissions from livestock categories

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<sup>11</sup> [https://unhabitat.org/sites/default/files/2019/11/climate-profile-english-version\\_resized.pdf](https://unhabitat.org/sites/default/files/2019/11/climate-profile-english-version_resized.pdf)

Table 2: Suggested emissions inventory method for livestock categories

Livestock	Suggested emissions inventory method
Dairy cow	Tier 2 / Tier 3
Other cattle	Tier 2 / Tier 3
Buffalo	Tier 1 / Tier 2
Sheep	Tier 1 / Tier 2
Goats	Tier 1
Swine	Tier 1
Poultry	Tier 1

57. For Myanmar to improve its sectoral GHG inventory, it can focus on moving to Tier 2 systems for
  - a. Dairy cow
  - b. Other cattle
  - c. Buffalo and
  - d. Sheep
58. The Tier 2 method is applied to more disaggregated livestock population categories and used to calculate emission factors, as opposed to default values. The key considerations for the Tier 2 method are the development of emission factors and the collection of detailed activity data.

### Step 1: Livestock population

59. The first step is in getting disaggregated data on livestock population and categorization, as described above.

### Step 2: Emission Factors

60. To move to Tier 2 methods, emission factors are estimated for each animal category developed in Step 1 above.
61. The emission factors for each category of livestock are estimated based on the gross energy intake and methane conversion factor for the category.

#### Obtaining the methane conversion factor ( $Y_m$ )

62. The extent to which feed energy is converted to CH<sub>4</sub> depends on several interacting feed and animal factors. Due to the importance of the methane conversion factor in driving emissions,

substantial ongoing research is aimed at improving estimates of this value for different livestock and feed combinations.

63. This is one area in which Myanmar can focus its efforts to improve its GHG inventory.

### Emission factor development

64. An emission factor for each animal category should be developed following Equation

$$EF = \left[ \frac{GE * \left( \frac{Y_m}{100} \right) * 365}{55.65} \right]$$

Where,

EF: Emission factor, kg CH<sub>4</sub> / head / year

GE: Gross energy intake, MJ / head / year

Y<sub>m</sub>: Methane conversion factor, per cent of gross energy in feed converted to methane

### Step 3: Total emissions

65. To estimate total emissions, the selected emission factors are multiplied by the associated animal population and summed and reported in Gigagrams (Gg).
66. There is potential to improve the systems to Tier 3 in future iterations through further research.

## Data Needs: Tier 2

67. Annual average population (number of livestock or poultry as per calculations for Tier 1)
68. Average daily feed intake (megajoules (MJ) per day and / or kg per day of dry matter)
69. Methane conversion factor (percentage of feed energy converted to methane)
70. Currently the country does not have systems to collect this kind of information as this is a very time consuming process, and especially gathering this information for the different climate zones.
71. At the moment this information is not being collected as well, however this kind of data could be available at the township level. To be used at national level numbers, a representative sample could be used.
72. Community animal health workers can be mobilized to gather this kind of data but need financial and technical support to implement this.
73. Cows
- a. High-producing cows that have calved at least once and are used principally for milk production
  - b. Low-producing cows that have calved at least once and are used principally for milk production
74. Other Mature Cattle or Mature Non-dairy Buffalo
- a. Females

- i. Cows used to produce offspring for meat
    - ii. Cows used for more than one production purpose: milk, meat, draft
  - b. Males
    - i. Bulls used principally for breeding purposes
    - ii. Bullocks used principally for draft power
- 75. Growing Cattle or Growing Buffalo
  - a. Calves pre-weaning
  - b. Replacement dairy heifers
  - c. Growing / fattening cattle or buffalo post-weaning
  - d. Feedlot-fed cattle on diets containing > 90 % concentrates
- 76. Mature Ewes
  - a. Breeding ewes for production of offspring and wool production
  - b. Milking ewes where commercial milk production is the primary purpose
- 77. Growing Lambs
  - a. Intact males
  - b. Castrates
  - c. Females
- 78. Mature Swine
  - a. Sows in gestation
  - b. Sows which have farrowed and are nursing young
  - c. Boars that are used for breeding purposes
- 79. Growing Swine
  - a. Nursery
  - b. Finishing
  - c. Gilts that will be used for breeding purposes
  - d. Growing boars that will be used for breeding purposes
- 80. Chickens
  - a. Broiler chickens grown for producing meat
  - b. Layer chickens for producing eggs, where manure is managed in dry systems (e.g., high-rise houses)
  - c. Layer chickens for producing eggs, where manure is managed in wet systems (e.g., lagoons)
  - d. Chickens under free-range conditions for egg or meat production
- 81. Ducks
  - a. Breeding ducks
  - b. Ducks grown for producing meat

## Methane emissions from Manure Management

82. Methane emissions occur from manure, both dung and urine, produced by livestock and how it is deposited in pastures as well as stored and treated.
83. The decomposition of manure under anaerobic conditions (i.e., in the absence of oxygen), during storage and treatment, produces methane. These conditions occur most readily when large numbers of animals are managed in a confined area (e.g., dairy farms, beef feedlots, and swine and poultry farms), and where manure is disposed of in liquid-based systems.
84. The main factors affecting methane emissions are the amount of manure produced and the portion of the manure that decomposes anaerobically. The former depends on the rate of waste production per animal and the number of animals, and the latter on how the manure is managed. When manure is stored or treated as a liquid (e.g., in lagoons, ponds, tanks, or pits), it decomposes anaerobically and can produce a significant quantity of methane.
85. The temperature and the retention time of the storage unit greatly affect the amount of methane produced. When manure is handled as a solid (e.g., in stacks or piles) or when it is deposited on pastures and rangelands, it tends to decompose under more aerobic conditions and less methane is produced.
86. To develop Tier 2 systems for estimating GHG emissions, a more complex method for estimating methane emissions from manure management should be used where a particular livestock species/category represents a significant share of a country's emissions.
87. This method requires detailed information on animal characteristics and manure management practices, which is used to develop emission factors specific to the conditions of the country.
88. The following four steps are used to estimate CH<sub>4</sub> emissions from manure management
  - a. Step 1: Collect population data from the Livestock Population Characterisation. As described above, livestock population data and characterisation systems have to be improved.
  - b. Step 2: Develop country-specific emission factors for each livestock subcategory. The country-specific emission factors for each livestock category is to be determined in terms of kilograms of methane per animal per year.
  - c. Step 3: Multiply the livestock subcategory emission factors by the subcategory populations to estimate subcategory emissions, and sum across the subcategories to estimate total emissions by primary livestock species.
  - d. Step 4: Sum emissions from all defined livestock species to determine national emissions

### Emission factor

89. The IPCC 2006 Guidelines state that it is a good practice to use Tier 2 systems for manure management system as cattle, buffalo and swine characteristics and manure management systems can vary significantly by country. The methane emission factor depends on the following factors.
90. **Manure characteristics:** Includes the amount of volatile solids (VS) produced in the manure and the maximum amount of methane able to be produced from that manure (Bo). Production of manure VS can be estimated based on feed intake and digestibility, which were developed for

enteric fermentation. Another method would be to use laboratory measurements of livestock manure. Bo varies by animal species and feed regimen and is a theoretical methane yield based on the amount of VS in the manure.

91. **Manure management system characteristics:** This includes the types of systems used to manage manure and a system-specific methane conversion factor (MCF) that reflects the portion of Bo that is achieved.
92. The typical manure management systems are as given in the table below.

**Table 3: Manure management systems**

SYSTEM	DEFINITION
<b>Pasture/Range/Paddock</b>	The manure from pasture and range grazing animals is allowed to lie as deposited and is not managed.
<b>Daily spread</b>	Manure is routinely removed from a confinement facility and is applied to cropland or pasture within 24 hours of excretion
<b>Solid storage</b>	The storage of manure, typically for a period of several months, in unconfined piles or stacks. Manure is able to be stacked due to the presence of a sufficient amount of bedding material or loss of moisture by evaporation.
<b>Dry lot</b>	A paved or unpaved open confinement area without any significant vegetative cover where accumulating manure may be removed periodically.
<b>Liquid/Slurry</b>	Manure is stored as excreted or with some minimal addition of water in either tanks or earthen ponds outside the animal housing, usually for periods less than one year.
<b>Uncovered anaerobic lagoon</b>	A type of liquid storage system designed and operated to combine waste stabilization and storage. Lagoon supernatant is usually used to remove manure from the associated confinement facilities to the lagoon. Anaerobic lagoons are designed with varying lengths of storage (up to a year or greater), depending on the climate region, the volatile solids loading rate, and other operational factors. The water from the lagoon may be recycled as flush water or used to irrigate and fertilise fields.
<b>Pit storage below animal confinements</b>	Collection and storage of manure usually with little or no added water typically below a slatted floor in an enclosed animal confinement facility, usually for periods less than one year.
<b>Anaerobic digester</b>	Animal excreta with or without straw are collected and anaerobically digested in a large containment vessel or covered lagoon. Digesters are designed and operated for waste stabilization by the microbial

SYSTEM	DEFINITION
	reduction of complex organic compounds to CO <sub>2</sub> and CH <sub>4</sub> , which is captured and flared or used as a fuel.
<b>Burned for fuel</b>	The dung and urine are excreted on fields. The sun dried dung cakes are burned for fuel.
<b>Cattle and Swine deep bedding</b>	As manure accumulates, bedding is continually added to absorb moisture over a production cycle and possibly for as long as 6 to 12 months. This manure management system also is known as a bedded pack manure management system and may be combined with a dry lot or pasture.
<b>Composting-in-vessel</b>	Composting, typically in an enclosed channel, with forced aeration and continuous mixing.
<b>Composting – Static pile</b>	Composting in piles with forced aeration but no mixing.
<b>Composting – Intensive windrow</b>	Composting in windrows with regular (at least daily) turning for mixing and aeration.
<b>Composting – Passive windrow</b>	Composting in windrows with infrequent turning for mixing and aeration.
<b>Poultry manure with litter</b>	Similar to cattle and swine deep bedding except usually not combined with a dry lot or pasture. Typically used for all poultry breeder flocks and for the production of meat type chickens (broilers) and other fowl.
<b>Poultry manure without litter</b>	May be similar to open pits in enclosed animal confinement facilities or may be designed and operated to dry the manure as it accumulates. The latter is known as a high-rise manure management system and is a form of passive windrow composting when designed and operated properly.
<b>Aerobic treatment</b>	The biological oxidation of manure collected as a liquid with either forced or natural aeration. Natural aeration is limited to aerobic and facultative ponds and wetland systems and is due primarily to photosynthesis. Hence, these systems typically become anoxic during periods without sunlight.

93. The uncertainty of the manure management system usage data will depend on the characteristics of Myanmar's livestock industry and how information on manure management is collected. Improving these collecting systems are a best way to improve the GHG inventory.
94. The system MCF varies with the manner in which the manure is managed and the climate, and can theoretically range from 0 to 100%. Both temperature and retention time play an important role in the calculation of the MCF.

95. Manure that is managed as a liquid under warm conditions for an extended period of time promotes methane formation. These manure management conditions can have high MCFs, of 65 to 80%. Manure managed as dry material in cold climates does not readily produce methane, and consequently has an MCF of about 1%.
96. Development of Tier 2 emission factors involves determining a weighted average MCF using the estimates of the manure managed by each waste system within each climate region. The average MCF is then multiplied by the VS excretion rate and the Bo for the livestock categories.

$$EF_{(T)} = (VS_{(T)} * 365) * \left[ B_{o(T)} * 0.67 \text{ kg} / \text{m}^3 * \sum_{S,k} \frac{MCF_{S,k}}{100} * MS_{(T,S,k)} \right]$$

Where,

- $EF_{(T)}$  Annual CH<sub>4</sub> emission factor for livestock category T, kg CH<sub>4</sub> / animal / yr
- $VS_{(T)}$  Daily volatile solid excreted for livestock category T, kg dry matter / animal / day
- 365 Basis for calculating annual VS production, days / yr
- $B_{o(T)}$  Maximum methane producing capacity for manure produced by livestock category T, m<sup>3</sup> CH<sub>4</sub> / kg of VS excreted
- 0.67 Conversion factor of m<sup>3</sup> CH<sub>4</sub> to kilograms CH<sub>4</sub>
- $MCF_{(S,k)}$  Methane conversion factors for each manure management system S by climate region k, %
- $MS_{(T,S,k)}$  Fraction of livestock category T's manure handled using manure management system S in climate region k, dimensionless

97. Country-specific data elements such as animal mass, VS excretion, and others can be used to improve emission estimates.
98. Measurement programs can be used to improve the basis for making the estimates. In particular, measurements of emissions from manure management systems under field conditions are useful to verify MCFs. Also, measurements of Bo from livestock in tropical regions and for varying diet regimens are needed to expand the representativeness of the default factors.
99. As emissions can vary significantly by region and livestock species/category, emission estimates should reflect as much as possible the diversity and range of animal populations and manure management practices between different regions within a country. This may require separate estimates to be developed for each region. Emission factors should be updated periodically to account for changes in manure characteristics and management practices. These revisions should be based on reliable scientifically reviewed data. Frequent monitoring is desirable to verify key model parameters and to track changing trends in the livestock industry.
100. VS excretion rates: Volatile solids (VS) are the organic material in livestock manure and consist of both biodegradable and nonbiodegradable fractions. The value needed for the above equation is the total VS (both degradable and nonbiodegradable fractions) as excreted by each animal species since the Bo values are based on total VS entering the systems.
101. The best way to obtain average daily VS excretion rates is to use data from nationally published sources. If average daily VS excretion rates are not available, country-specific VS excretion rates can be estimated from feed intake levels.
102. The VS content of manure equals the fraction of the diet consumed that is not digested and thus excreted as fecal material which, when combined with urinary excretions, constitutes manure.

103.  $B_0$  values: The maximum methane-producing capacity of the manure ( $B_0$ ) varies by species and diet. The preferred method to obtain  $B_0$  measurement values is to use data from country-specific published sources, measured with a standardised method. It is important to standardise the  $B_0$  measurement, including the method of sampling, and to confirm if the value is based on total as-excreted VS or biodegradable VS, since the Tier 2 calculation is based on total as-excreted VS.
104. MCF values: Country-specific MCFs that reflect the specific management systems used in particular countries or regions should be developed for Myanmar. These studies should monitor the following:
  - a. Timing of storage/application;
  - b. Feed and animal characteristics at the measurement site (see Section 10.2 for the type of data that would be pertinent);
  - c. Length of storage;
  - d. Manure characteristics (e.g., VS influent and effluent concentrations for liquid systems);
  - e. Determination of the amount of manure left in the storage facility (methanogenic inoculum);
  - f. Time and temperature distribution between indoor and outdoor storage;
  - g. Daily temperature fluctuation; and
  - h. Seasonal temperature variation

## Current data and information collection systems

105. Livestock department is responsible for enumerating households and animals / household for over twenty years. However, now they are progressing towards using statistical methods to get the numbers.
106. Different data sets are available at statistical department vs administration and agriculture department. To ensure consistency in approaches, statistical data will be used for GHG estimates.
107. The data flow arrangements function each year as follows:
  - a. Before 1<sup>st</sup> April, data from all townships and veterinary departments is collected
  - b. Fiscal year statistical data is checked in the middle of the year and if there is any progress, then values are corrected.
  - c. Data flows are as follows:
    - i. from township to district at monthly basis
    - ii. from district to regional at quarterly basis
    - iii. from regional to HQ national level at quarterly basis
  - d. Data takes about one year to be certified
  - e. Transfer of data is usually at Ministerial levels on requests for data
  - f. Data consistency, data outlier, and other statistical checks are carried out at HQ level
108. Data sharing systems, laws and regulations: Currently there are no laws or regulations in place that make the end-users provide this data. However, this data has been collected for the past

several years. The data collection template is currently an MS Excel format sheet. Data collected by the Ministry can be shared with DCC but may need to be done at Ministerial level.

109. QA/QC procedures: Currently staff at HQ have the technical capacity to conduct QA/QC analysis, but that only focuses on statistical analyses. Few years ago, FAO had a project with SCADA / SATA software provided, however, without continued support it fell into disuse and is no longer relied upon. Staff at township level do preliminary data checks and are responsible for signing off data collected.
110. Data formats: Information on what raw data is collected and shared isn't too clear.
111. Data retention periods: More information is needed on the means and modes of data retention.
112. Emission factors: Currently the department is carrying out the GHG calculations and then sharing the data with DCC. Currently default emission factors for both enteric fermentation and manure management are being used. More detailed information on the data needed for country-specific emission factors is to be collected.
113. The following are the key stakeholders involved in providing the data:
  - a. Ministry of Agriculture, Livestock and Irrigation
  - b. Department of Agriculture
  - c. Department of Agricultural Research
  - d. Livestock Breeding and Veterinary Department
  - e. University of Veterinary Science
  - f. Yezin Agriculture University (YAU)
114. The following international partner agencies are also stakeholders who are supporting the Government of Myanmar on several projects
  - a. World Organization for Animal Health
  - b. FAO
  - c. JICA
  - d. KOICA
  - e. UNDP
  - f. New Zealand Government
  - g. Australian Government

# CHALLENGES AND RECOMMENDATIONS

## Challenges

115. Building national and sectoral MRV systems requires the development of the following elements:
  - a. Organisation – clear mandates, roles and responsibilities that bring people and data together to fulfil objectives to support decision makers.
  - b. Data flows – the regular movement of data from specific data collection services into useful analysis and reports.
  - c. Expertise – teams of individuals that understand the data and can use it to provide clear messages and indicators.
  - d. Tools – the systems, templates, workplans, models and services available to ensure data flows, experts can work efficiently, and the system can inform decision makers.
  - e. Stakeholder Engagement – the valued input of any stakeholders that provide data, tools, services, expertise and use the data and outputs of the MRV system.
116. ECD has the data requesting authority from each ministry. However, the response is often delayed due to capacity challenges in understanding the requirements.
117. Furthermore, while there is room to improve on data collection, recording and management, ECD cannot drive these improvements forward by itself, it needs support at ministerial level.
118. To calculate GHG emissions from the Livestock sector, activity data collection process is beyond the regular data collection activities carried out by responsible entities, which in themselves face delays due to human, technical and financial challenges and require constant follow-up.
119. The process of data request and collection is also procedural. To initiate the data process each time, ECD sends official letters to each ministry, which in turn send their own letters to their respective companies and other entities requesting data.
120. From the first national communication, data was eventually acquired to produce a basic GHG inventory but it was very laborious and costly to collect. Often, several personal visits to the source of the data (ministry, association or private company) over several months had to be carried out in order to acquire the data.
121. In few instances, proxy data had to be pieced together to reconstruct missing data.<sup>12</sup>
122. There are ad-hoc arrangements for regular collection of certain data points and each ministry has responsibility for its own data collection. However, these data collection frequency and methods vary from ministry to ministry.

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<sup>12</sup> Seres, Stephen. 2017. The Status of Monitoring, Reporting and Verification of Nationally Determined Contributions to Climate Actions in Myanmar. GGGI/MoNREC MRV Project Report No.1

## Recommendations

123. There are systems for collection of data and information, but to support the regular creation of national and sectoral GHG inventories, Myanmar needs to implement the following systems:
  - a. Existing legal instruments and data and information collection systems must be reviewed and revised
  - b. A framework for data flow expertise and standards for reporting and data collection has to be created
  - c. The country needs to develop regulations or in the least, specific terms of reference for the various stakeholders for monitoring and reporting of data and information
  - d. These data and information collection systems can be further made robust with non-GHG related mechanisms as well
124. The ECD is building its capacity to deal with GHG related data and information collection. Building on existing systems of ad-hoc data collection for the SNC, ECD is seeking funds from the GEF through the CBIT project to further consolidate these arrangements into regular reporting lines. However, the following elements can be further improved:
  - a. The country can create an organogram for systematic and regular data and information collection.
  - b. A consolidated, and up-to-date stakeholder consultations map and registry needs to be created. This needs to be another living document to ensure that latest updates in economic activity in the country are readily reflected
  - c. The stakeholders from not just other ministries, but also private sector and the universities have to be added. Further, the scope of this analysis should include sub-national systems as well.
  - d. There should be renewed top-level commitment from the Government of Myanmar, in terms of legislation or steering committee or other such mechanism to indicate leadership and ownership of the GHG inventory process.
  - e. The country can populate an experts roster which will serve as the starting point for GHG inventory creation.
  - f. Furthermore, the country needs to identify its human resource gaps for conducting several kinds of analysis with the collected data and information: be it projections of different scenarios, or to assess the climate finance needed to achieve them, or to postulate the jobs that would be created, and people who need to be re-trained.
125. On the allocation of resources for the regular collection of data and information needed for the GHG inventory, the country needs to prepare and implement robust planning.
  - a. Currently only ad-hoc arrangements are in place to support this type of GHG inventory preparation. These have been supported financially by the GEF (National communications and biennial update reports) or other agencies.
  - b. Longer-term solutions are the allocation of internal resource streams, and embedding regular data collection and sharing between ministries, departments as well as other public and private sector bodies.
  - c. The resource allocation should also include requirements for public dissemination and general awareness raising.

126. Laws and regulations for data collection and sharing have to be implemented in the country. There are two layers of laws and regulations required to support regular production of GHG inventory.
  - a. The first one involves the review and update of existing environmental laws and regulations to include data and information required from the various economic activities currently being undertaken in the country. This includes public and private institutions, industries, societies and other sources. Where data points are not being collected, these can be either added on to existing systems, or new laws and regulations have to be created. This could be the case where either the economic activities are newly introduced into the country, or there are existing thresholds which have been exceeded.
  - b. The second looks at systems for sharing of collected data and information between various ministries and departments and ECD. This can be achieved by either creating new regulation or be formalizing existing ad-hoc arrangements into formal ones.
  - c. These arrangements could either look at specific data flows, by establishing specific data points that need to be shared at specified intervals. Or they could look at over-arching umbrella agreements between responsible stakeholders so that fresh arrangements are not required each time a new data point is added to the list.
  - d. Analysis has to be done on the congruence of data and information collection systems with those serving other purposes, such as SDGs.
127. The country needs to develop a GHG database management system (DBMS) with the following features:
  - a. There must be effective regulatory framework available to enable the establishment and operation of an effective GHG database management system.
  - b. It should be able to clearly identify existing institutions and place systems to add and remove institutions, designating key contact personnel and providing them access to the DBMS
  - c. It should have clearly defined roles and responsibilities for
    - i. A statutory regulator
    - ii. A program administrator
    - iii. An IT developer
    - iv. A system developer
    - v. An end-user
  - d. The system should also be able to act as a primary point of QA/QC, ensuring that incorrect data (such as a number beyond a range, or text instead of number) is not entered
128. A QA/QC system needs to be developed for the country. While there are existing QA/QC systems in place, the levels of uncertainty in the GHG inventory have to be improved.



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